REMARKS

Claims 1-19 were pending of which Claims 6, 8, and 11-19 were withdrawn from consideration. Claims 1-5, 7, 9, and 10 were rejected. Claim 10 has been have been amended and Claims 11-19 have been cancelled.

Specification

The specification has been amended to correct syntax errors. No new matter has been added.

Claim Objections

Claims 10 was objected to as containing an informality. In particular, the Examiner stated that "and film" should be removed for clarity. Claim 10 has been so amended.

Claim Rejections – 35 U.S.C. §112

Claim 3 was rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. In particular, the Examiner stated that "[i]f the measurement is taken 'during' –rather than after—the deposition of the film, all of the film will not yet have been deposited; therefore, the mass determination will necessarily be inaccurate and all the subsequent calculations using the measurement will be inaccurate."

The operation of a coulometer is discussed in the specification, e.g., at the paragraph beginning on page 7, line 1, et seq. As noted in the specification, a "coulometer measures the amount of charge (Q) that passes through an electrochemical cell during a plating process, from which the total amount of material deposited on a sample can be determined." Accordingly, Applicant submits that Claim 3, which recites "taking a coulometer measurement during the deposition of the film on the substrate" is definite.

Reconsideration and withdrawal of this rejection is respectfully requested.

Claim Rejections – 35 U.S.C. §103

Nulman, APA, and the Dictionary

Claims 1, 4, 5, and 7 were rejected under 35 U.S.C. §103(a) as being unpatentable over Nulman (5,698,989) ("Nulman") in view of Applicant's admitted prior art ("APA") and

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The Penguin Dictionary of Electronics, 3rd ed., Penguin Books: London, 1998, pp. 486, 513 ("Dictionary"). Applicant requests reconsideration.

Nulman is related to measuring "the sheet resistance of an electrically conductive film immediately after the deposition of the film on a semiconductor substrate." Col. 1, lines 8-11. The thickness of deposited films is monitored in Nulman by measuring the sheet resistance of the film and comparing the measured sheet resistance to a baseline resistance value that is determined using a "a film of a known thickness and composition". Col. 1, lines 40-57. The "baseline value can be compared to actual measured values of the sheet resistance of the film layer on the substrate, so as to monitor the thickness of the film layer." Col. 1, lines 49-51.

Thus, Nulman does not teach or suggest that the thickness of a deposited film is determined using the sheet resistance. Nulman merely compares the measured sheet resistance values against a baseline value, which is generated based on a film with a known thickness and known composition, to determine if the deposited film is too thin or too thick.

Nulman generally describes the conventional method of eddy current measurements, which use a resitivity from a source other than the sample being measured. For example, Nulman uses an assumed or measured data from a previous measurement, i.e., to generate a baseline, which is used to determine whether the layer in the measured sample is too thick or too thin. The use of a resistivity from a different source than that being measured, as described in Nulman, is problematic as it assumes the measured sample has the same resistivity. This assumption is not necessarily correct and can be a source of a large error. Accordingly, Nulman's thickness measurement includes an error that is related to the difference in the resistivity between the baseline and the measured sample.

Claim 1, on the other hand, addresses determining the thickness of a film at a location on the substrate "using the average resistivity and the determined sheet resistance of the film at the location." Thus, unlike Nulman, Claim 1 does not use a baseline value that is generated from a different sample. By using the average resistivity from the same sample that is being measured, Claim 1 advantageously avoids the source of error encountered in Nulman. Accordingly, the method of Claim 1 accounts for differences in resistivity from one sample to the next, whereas Nulman does not account for those differences.

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The Examiner stated that Nulman discloses "depositing a film on a substrate 24". **Nulman, however, does not teach or suggest "determining the average thickness of a film** deposited over a substrate", which is what is recited in Claim 1.

The Examiner also stated that Nulman discloses "determining the thickness the plurality of locations using the determined sheet resistance of the film at the location." As discussed above, Nulman does not teach or suggest "determining the thickness", but merely compares the measured sheet resistance to a baseline to determine if the thickness of the film is too thick or too thin. **According to the teaching of Nulman, the thickness of the measured film remains unknown and is, therefore, undetermined**. Moreover, Nulman does not teach or suggest "determining the thickness of at least one location of the plurality of locations using the average resistivity and the determined sheet resistance of the film at the location", which is what is recited in Claim 1.

Additionally, Nulman does not teach or suggest that "calculating the average resistivity using the average thickness of the film and the average sheet resistance". The Examiner correctly recognized that "Nulman does not indicate the manner in which the average resistivity is determined". However, while not explicitly stated, the Examiner appears to be taking the position that Nulman teaches that the average resistivity of the film is determined in Nulman. For example, the Examiner stated that "Nulman does, however, state col. 1, lines 43-45, 'The bulk resistance [i.e., resistivity] of any desired material composition can be determined experimentally ....'" Applicant points out, however, that Nulman's discussion of bulk resistance is related to determining a baseline resistance value from "a film of known thickness and composition", which can be used to compare against a measured value. See, col. 1, lines 43-50. Thus, Nulman does not teach or suggest "calculating the average resistivity" of the film or "using the average thickness of the film and the average sheet resistance" as recited in Claim 1.

The Examiner goes on to use a statement in the Applicant's background (which the Examiner refers to as the APA) regarding a known correlation between the sheet resistance, film thickness, and resistivity, and the Dictionary definitions of sheet resistance and resistivity, in an attempt to cobble together the remaining elements of Claim 1. Applicant notes, however, that **the Examiner provides no motivation or suggestion to modify Nulman using the APA and the Dictionary**. Thus, a *prima facie* case of obviousness has

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not been made. At best, the Examiner appears to be saying that based on a dictionary definition and a known correlation between resistivity, sheet resistance, and film thickness, that what is claimed in Claim 1 is possible and, therefore, is obvious. However, merely because something is possible, it is not rendered obvious.

Moreover, **Applicant submits that even if Nulman were modified with the APA and the Dictionary, the combination would still not contain all the elements of Claim 1**. Accordingly, a *prima facie* case of obviousness has not been made.

For example, the Examiner stated that it would have been obvious "to determine the average sheet resistance, to determine the average resistivity of the thin film, and finally to calculate the thin film thickness from the sheet resistance measurements and the average resistivity, as expressly suggested by APA to be known in the art." Applicant disagrees. The APA relied upon by the Examiner states "While the standard eddy current sensor cannot measure the actual film thickness, the measured sheet resistance can be converted into film thickness with knowledge of the resistivity of the material." Applicant notes that **there is neither an explicit nor an implicit reference in the APA to an "average sheet resistance", "average resistivity", or calculating the thickness of the film "using the sheet resistance measurements and the average resistivity**". Accordingly, even if Nulman was modified with the APA, Nulman would still not determine an "average sheet resistance", and "average resistivity", or calculating the thickness of the film using "the average resistivity" as recited in Claim 1.

Further, the Examiner stated that it would have been obvious to "determine the average thickness of the conductive thin film and the average sheet resistance in Nulman in order to determine the average resistivity ρ, because the Dictionary teaches that the average thickness, t, is required to calculate the resistivity, ρ, and because APA teaches that 'knowledge of the resistivity,' ρ, is required for calculation of the film thickness at any given location. Applicant again disagrees. **The Dictionary does not teach or suggest that the average thickness is required to calculate the resistivity**. The Dictionary merely states that "t [is] the thickness", not "the average thickness". Thus, even if Nulman were modified with based on the APA and the Dictionary, Nulman would still not determine the "average thickness" as recited in Claim 1.

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Thus, Applicant respectfully submits that Claim 1 is patentable over the combination of Nulman, the APA and the Dictionary. Reconsideration and withdrawal of this rejection is respectfully requested. Claims 4, 5, and 7 depend from Claim 1 and are, therefore, likewise patentable.

Sato, the APA, and the Dictionary

Claims 1 and 4 were rejected under 35 U.S.C. §103(a) as being unpatentable over Sato (2002/0070126) ("Sato") in view of Applicant's admitted prior art ("APA") and The Penguin Dictionary of Electronics, 3rd ed., Penguin Books: London, 1998, pp. 486, 513 ("Dictionary"). Applicant requests reconsideration.

Sato states "The thickness of the copper film can be measured ... for example, by using the method of measuring the sheet resistance with a four-probe type sheet resistance meter and converting it to thickness using a known sheet resistance or by using the method of measuring thickness equivalent data by an eddy current type detector or an electrostatic capacitance type detector." Sato uses a conventional eddy current measurement, which as described above, includes an error related to the resistivity. Thus, Sato suffers from the same disadvantages as Numan discussed above.

The Examiner notes that "Sato does not indicate the measurements and calculations associated with the eddy current probe measurements that are used to determine the thickness of the copper film at the plurality of locations." The Examiner relies upon the APA and the Dictionary for the specific elements of Claim 1, in a manner similar to the rejection based on Nulman.

Applicant submits that the Examiner failed to provide a suggestion or motivation to combine the APA and the Dictionary with Sato. Moreover, as per the discussion above, even if Sato were modified by the APA and the Dictionary, all the elements of Claim 1 would still not be disclosed. Accordingly, a *prima facie* case of obviousness has not been made.

Thus, Applicant respectfully submits that Claim 1 is patentable over the combination of Sato, the APA and the Dictionary. Reconsideration and withdrawal of this rejection is respectfully requested. Claim 4 depends from Claim 1 and are, therefore, likewise patentable.

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Sato, the APA, the Dictionary, and Katsumaru

Claims 2 and 3 were rejected under 35 U.S.C. §103(a) as being unpatentable over Sato in view of the APA and the Dictionary and further in view of Katsumaru (6,790,331) ("Katsumaru"). Reconsideration is requested.

As recognized by the Examiner Katsumaru is related to measuring the thickness of a deposited film using a coulometer. Accordingly, Katsumaru does not make up for the deficiencies of Sato, the APA and the Dictionary as related to Claim 1. Claims 2 and 3 depend from Claim 1 and are therefore patentable for at least the same reasons as Claim 1.

Sato, the APA, the Dictionary, and Libby

Claim 9 was under 35 U.S.C. §103(a) as being unpatentable over Sato in view of the APA and the Dictionary and further in view of Libby et al. (4,084,136) ("Libby"). Reconsideration is requested.

As noted by the Examiner, Libby describes generally, the eddy current testing and the use of single or multiple excitation frequencies (col. 1, lines 14-41). Libby does not make up for the deficiencies of Sato, the APA and the Dictionary as related to Claim 1. Claim 9 depends from Claim 1 and are therefore patentable for at least the same reasons as Claim 1.

Sato, the APA, the Dictionary, and Mikhin

Claim 10 was under 35 U.S.C. §103(a) as being unpatentable over Sato in view of the APA and the Dictionary and further in view of Mikhin (SU 1613847) ("Mikhin"). Reconsideration is requested.

As noted by the Examiner, Mikhin is related to the use of eddy current measurements to measure the base before and after coating. Mikhin does not make up for the deficiencies of Sato, the APA and the Dictionary as related to Claim 1. Claim 10 depends from Claim 1 and are therefore patentable for at least the same reasons as Claim 1.

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Claim 10 has been amended and Claims 11-19 have been cancelled, leaving Claims 1-10 pending and Claims 6 and 8 withdrawn. For the above reasons, Applicants respectfully

respectfully request allowance of Claims 1-10. Should the Examiner have any questions concerning this response, the Examiner is invited to call the undersigned at (408) 982-8202.

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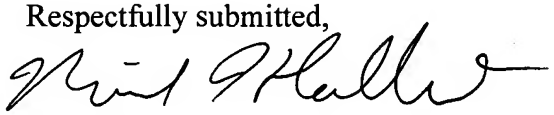
Respectfully submitted,



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